

PART V WELDING

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WAC 296-307-475 Welding, cutting, and brazing.

[Recodified as § 296-307-475. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-475, filed 10/31/96, effective 12/1/96.]

WAC 296-307-47501 What definitions apply to this part?

“Welder” and “welding operator” mean any operator of electric or gas welding and cutting equipment.

All other welding terms are defined according to American Welding Society, Terms and Definitions, A3.0-1969.

[Recodified as § 296-307-47501. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-47501, filed 10/31/96, effective 12/1/96.]

WAC 296-307-480 Installation and operation of oxygen fuel gas systems for welding and cutting.

[Recodified as § 296-307-480. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-480, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48001 What general requirements apply to oxygen fuel gas systems?

- (1) Explosive mixtures of fuel gases and air or oxygen must be guarded against. No accessory that allows air or oxygen to mix with flammable gases prior to use must be allowed unless approved for that purpose.

Exception: Air or oxygen may mix with flammable gases at the burner or in a standard torch.

- (2) Acetylene must never be generated, piped (except in approved cylinder manifolds) or used at a pressure in excess of 15 psi gauge pressure or 30 psi absolute pressure. (The 30 psi absolute pressure limit is intended to prevent unsafe use of acetylene in pressurized chambers such as caissons, underground excavations or tunnel construction.) Using liquid acetylene is prohibited.

Exception: This requirement does not apply to storage of acetylene dissolved in a suitable solvent in cylinders manufactured and maintained according to DOT requirements, or to acetylene for chemical use.

- (3) Only approved apparatus such as torches, regulators or pressure-reducing valves, acetylene generators, and manifolds must be used. Replacement tips may be used on approved torches, if the replacement tips are made to the same specifications as the original, or when replacements are used with convertor/adaptors that meet the same specifications.

WAC 296-307-48001 (Cont.)

- (4) Before leaving any employee in charge of the oxygen or fuel-gas supply equipment, including generators, and oxygen or fuel-gas distribution piping systems, you must ensure that the employee has received proper instruction and is competent to do the work. Rules and instructions covering the operation and maintenance of oxygen or fuel-gas supply equipment including generators, and oxygen or fuel-gas distribution piping systems must be readily available.

[Recodified as § 296-307-48001. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48001, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48003 What requirements apply to portable cylinders? All portable cylinders used for storing and shipping compressed gases must be constructed and maintained according to DOT regulations.

- (1) Compressed gas cylinders must be legibly marked with either the chemical or the trade name of the gas. The marking must be a permanent stencil, stamp, or label. Whenever practical, the marking must be located on the shoulder of the cylinder.
- (2) Compressed gas cylinders must have connections that meet the requirements of the American National Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections, ANSI B 57.1-1965.
- (3) All cylinders with a water weight capacity greater than thirty pounds must have means of connecting a valve protection cap or with a collar or recess to protect the valve.

[Recodified as § 296-307-48003. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48003, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48005 What general requirements apply to storing compressed gas cylinders?

- (1) Cylinders must be kept away from radiators and other sources of heat.
- (2) Indoors, cylinders must be stored in a well-protected, well-ventilated, dry area, at least twenty feet from highly combustible materials such as oil or excelsior. Cylinders should be stored in assigned places away from elevators, stairs, or gangways. Assigned storage spaces must be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering. All cylinder enclosures must be ventilated.
- (3) Empty cylinders must have their valves closed.
- (4) Valve protection caps on cylinders designed to accept a cap, must always be in place and hand-tight, except when cylinders are in use or connected for use.

[Recodified as § 296-307-48005. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48005, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48007 How must fuel-gas cylinders be stored? Cylinders stored indoors, except those in use or attached ready for use, must be limited to a total gas capacity of 2,000 cubic feet or 300 pounds of LP-gas.

- (1) Cylinders in excess of 2,000 cubic feet total gas capacity or 300 pounds of LP-gas, must be stored in a separate room or compartment that meets the requirements of 252 (a)(8) and (9) CFR, or cylinders must be kept outside or in a special building. Special buildings, rooms or compartments must be free from open flame for heating or lighting and must be well ventilated. They may also be used for storage of a maximum of 600 pounds of calcium carbide, when contained in metal containers complying with 252 (a)(7)(a) and (b) CFR. Signs should be conspicuously posted in such rooms reading, "Danger-No smoking, matches or open lights," or other equivalent wording.
- (2) Acetylene cylinders must be stored valve end up.

[Recodified as § 296-307-48007. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48007, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48009 How must oxygen cylinders be stored?

- (1) Oxygen cylinders must not be stored near highly combustible material, especially oil and grease; or near reserve stocks of carbide and acetylene or other fuel-gas cylinders, or near any other substance likely to cause or accelerate fire; or in an acetylene generator compartment.
- (2) Oxygen cylinders stored in outside generator houses must be separated from the generator or carbide storage rooms by a noncombustible partition having a fire-resistance rating of at least one hour. This partition must be without openings and must be gastight.
- (3) Oxygen cylinders in storage must be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum of 20 feet or by a noncombustible barrier at least five feet high having a fire-resistance rating of at least one-half hour. (Cylinders "in-use," secured to a hand truck or structural member, with regulators, hoses, and torch temporarily removed for security purposes overnight or weekends, are not considered "in-storage.")
- (4) Where a liquid oxygen system is to be used to supply gaseous oxygen for welding or cutting and the system has a storage capacity of more than 13,000 cubic feet of oxygen (measured at 14.7 psi(a) and 70°F), connected in service or ready for service, or more than 25,000 cubic feet of oxygen (measured at 14.7 psi(a) and 70°F), including unconnected reserves on hand at the site, it must meet the requirements of the Standard for Bulk Oxygen Systems at Consumer Sites, NFPA No. 566-1965.

[Recodified as § 296-307-48009. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48009, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48011 What general operating procedures apply to working with cylinders and containers?

- (1) The numbers and markings stamped into cylinders must not be tampered with.
- (2) Cylinders, cylinder valves, couplings, regulators, hose, and apparatus must be kept free from oily or greasy substances. Oxygen cylinders or apparatus must not be handled with oily hands or gloves. A jet of oxygen must never be permitted to strike an oily surface, greasy clothes, or enter a fuel oil or other storage tank.
- (3) Cylinders must be kept far enough away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them, or fire-resistant shields must be provided.
- (4) No person, other than the gas supplier, may attempt to mix gases in a cylinder. No one, except the owner of the cylinder or person authorized by the owner, may refill a cylinder.
- (5) Cylinders must not be placed where they might become part of an electric circuit. Contacts with third rails, trolley wires, etc., must be avoided.
- (6) Fuel-gas cylinders must be placed with valve end up whenever they are in use. Liquefied gases must be stored and shipped with the valve end up.
- (7) A suitable cylinder truck, chain, or other steadying device must be used to prevent cylinders from being knocked over while in use.

[Recodified as § 296-307-48011. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48011, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48013 What requirements apply to safety devices on cylinders?

- (1) Valve-protection caps must not be used for lifting cylinders from one vertical position to another. Bars must not be used under valves or valve-protection caps to pry cylinders loose when frozen to the ground or otherwise fixed; we recommend using warm (not boiling) water. Valve-protection caps are designed to protect cylinder valves from damage.

WAC 296-307-48013 (Cont.)

- (2) Cylinders without fixed hand wheels must have keys, handles, or nonadjustable wrenches on valve stems while these cylinders are in service. In multiple cylinder installations only one key or handle is required for each manifold.
- (3) No one may tamper with safety devices in cylinders or valves.
- (4) Nothing may be placed on top of an acetylene cylinder when in use that may damage the safety device or interfere with the quick closing of the valve.
- (5) Where a special wrench is required it must be left in position on the stem of the valve while the cylinder is in use so that the fuel-gas flow can be quickly turned off in case of emergency. In the case of manifolded or coupled cylinders at least one such wrench must always be available for immediate use.
- (6) Cylinders with leaking fuse plugs or other leaking safety devices should be plainly marked with a warning not to approach them with a lighted cigarette or other source of ignition. You should notify the supplier promptly and follow the supplier's instructions as to their return.

[Recodified as § 296-307-48013. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48013, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48015 How must cylinders be transported?

- (1) When transporting cylinders by a crane or derrick, a cradle, boat, or suitable platform must be used. Slings or electric magnets are prohibited for this purpose. Valve-protection caps, where cylinder is designed to accept a cap, must always be in place.
- (2) Unless cylinders are secured on a special truck, regulators must be removed and valve-protection caps, when provided for, must be put in place before cylinders are moved.
- (3) When cylinders are transported by powered vehicle they must be secured in a vertical position.

[Recodified as § 296-307-48015. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48015, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48017 How must cylinders be handled?

- (1) Cylinders must not be dropped or struck or permitted to strike each other violently.
- (2) Cylinders must be handled carefully. Cylinders must not be subjected to rough handling, knocks, or falls that are liable to damage the cylinder, valve or safety devices and cause leakage.
- (3) Cylinders must never be used as rollers or supports, whether full or empty.

[Recodified as § 296-307-48017. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48017, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48019 What requirements apply to cylinder valves?

- (1) Cylinder valves must be closed before moving cylinders
- (2) Cylinder valves must be closed when work is finished.
- (3) Valves of empty cylinders must be closed.
- (4) A hammer or wrench must not be used to open cylinder valves. If valves cannot be opened by hand, the supplier must be notified.

WAC 296-307-48019 (Cont.)

- (5) Cylinder valves must not be tampered with nor should any attempt be made to repair them. If you have trouble with a cylinder, you should send a report to the supplier indicating the character of the trouble and the cylinder's serial number. You must follow the supplier's instructions on what to do with the cylinder.
- (6) Complete removal of the stem from a diaphragm-type cylinder valve must be avoided.
- (7) If cylinders are found to have leaky valves or fittings that cannot be stopped by closing of the valve, the cylinders must be taken outdoors away from sources of ignition and slowly emptied.
- (8) The cylinder valve must always be opened slowly.
- (9) An acetylene cylinder valve must not be opened more than one and one-half turns of the spindle, and preferably no more than three-fourths of a turn.

[Recodified as § 296-307-48019. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48019, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48021 What requirements apply to cylinder regulators?

- (1) Unless connected to a manifold, oxygen from a cylinder must first have an oxygen regulator attached to the cylinder valve.
- (2) Before connecting a regulator to a cylinder valve, the valve must be opened slightly and closed immediately. The valve must be opened while standing to one side of the outlet; never in front of it. Fuel-gas cylinder valves must not be cracked near other welding work or near sparks, flame, or other possible sources of ignition.
- (3) Before a regulator is removed from a cylinder valve, the cylinder valve must be closed and the gas released from the regulator.
- (4) Fuel-gas must not be used from cylinders through torches or other devices equipped with shut-off valves without reducing the pressure through a suitable regulator attached to the cylinder valve or manifold.

[Recodified as § 296-307-48021. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48021, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48023 What requirements apply to fuel-gas manifolds?

- (1) Manifolds must be approved either separately for each component part or as an assembled unit.
- (2) Fuel-gas cylinders connected to one manifold inside a building must be limited to a maximum total capacity of 300 pounds of LP-gas or 3,000 cubic feet of other fuel-gas. More than one such manifold with connected cylinders may be located in the same room if the manifolds are at least 50 feet apart or separated by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.
- (3) Exception: Fuel-gas cylinders connected to one manifold having an aggregate capacity exceeding 300 pounds of LP-gas or 3,000 cubic feet of other fuel-gas must be located outdoors, or in a separate building or room constructed according to 252 (a)(8) and (9) CFR.
- (4) Separate manifold buildings or rooms may also be used for the storage of drums of calcium carbide and cylinders containing fuel gases as provided in WAC 296-307-48007. Such buildings or rooms must have no open flames for heating or lighting and must be well ventilated.

WAC 296-307-48023 (Cont.)

(5) High-pressure fuel-gas manifolds must have approved pressure regulating devices.

[Statutory Authority: 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-48023, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-48023. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48023, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48025 What requirements apply to high pressure oxygen manifolds? This section applies to cylinders with a DOT service pressure above 200 psig.

- (1) Manifolds must be approved either separately for each component or as an assembled unit.
- (2) Oxygen manifolds must not be located in an acetylene generator room. Oxygen manifolds must be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.
- (3) Oxygen cylinders connected to one manifold must be limited to a total gas capacity of 6,000 cubic feet. More than one such manifold with connected cylinders may be located in the same room if the manifolds are at least 50 feet apart or separated by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.
- (4) Exception: An oxygen manifold, to which cylinders having an aggregate capacity of more than 6,000 cubic feet of oxygen are connected, should be located outdoors or in a separate noncombustible building. Such a manifold, if located inside a building having other occupancy, must be located in a separate room of noncombustible construction having a fire-resistance rating of at least one-half hour or in an area with no combustible material within 20 feet of the manifold.
- (5) An oxygen manifold or oxygen bulk supply system that has storage capacity of more than 13,000 cubic feet of oxygen (measured at 14.7 psia and 70°F), connected in service or ready for service, or more than 25,000 cubic feet of oxygen (measured at 14.7 psia and 70°F), including unconnected reserves on hand at the site, must meet the requirements of the Standard for Bulk Oxygen Systems at Consumer Sites, NFPA No. 566-1965.
- (6) High-pressure oxygen manifolds must have approved pressure-regulating devices.
[Recodified as § 296-307-48025. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48025, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48027 What requirements apply to low pressure oxygen manifolds? This section applies to cylinders with a maximum DOT service pressure of 200 psig.

- (1) Manifolds must be of substantial construction suitable for use with oxygen at a pressure of 250 psig. They must have a minimum bursting pressure of 1,000 psig and must be protected by a safety-relief device that will relieve at a maximum pressure of 500 psig.

Note: DOT-4L200 cylinders have safety devices that relieve at a maximum pressure of 250 psig (or 235 psig if vacuum insulation is used).

- (2) Hose and hose connections subject to cylinder pressure must meet the requirements of WAC 296-307-48049. Hose must have a minimum bursting pressure of 1,000 psig.
- (3) The assembled manifold including leads must be tested and proven gas-tight at a pressure of 300 psig. The fluid used for testing oxygen manifolds must be oil-free and not combustible.
- (4) The location of manifolds must meet the requirements of WAC 296-307-48025.

WAC 296-307-48027 (Cont.)

- (5) The following sign must be conspicuously posted at each manifold:

Low-Pressure Manifold Do Not Connect High-Pressure Cylinders Maximum Pressure-250 PSIG
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[Statutory Authority: 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-48027, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-48027. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48027, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48029 What requirements apply to manifolding portable outlet headers?

- (1) Portable outlet headers must not be used indoors except for temporary service where the conditions preclude a direct supply from outlets located on the service piping system.
- (2) Each outlet on the service piping from which oxygen or fuel-gas is withdrawn to supply a portable outlet header must have a readily accessible shut-off valve.
- (3) Hose and hose connections used for connecting the portable outlet header to the service piping must meet the requirements of WAC 296-307-48051.
- (4) Master shut-off valves for both oxygen and fuel-gas must be provided at the entry end of the portable outlet header.
- (5) Portable outlet headers for fuel-gas service must have an approved hydraulic back-pressure valve installed at the inlet and preceding the service outlets, unless an approved pressure-reducing regulator, an approved backflow check valve, or an approved hydraulic back-pressure valve is installed at each outlet. Outlets provided on headers for oxygen service may be fitted for use with pressure-reducing regulators or for direct hose connection.
- (6) Each service outlet on portable outlet headers must have a valve assembly that includes a detachable outlet seal cap, chained or otherwise attached to the body of the valve.
- (7) Materials and fabrication procedures for portable outlet headers must comply with WAC 296-307-48033, 296-307-48035, and 296-307-48041.
- (8) Portable outlet headers must have frames that will support the equipment securely in the correct operating position and protect them from damage during handling and operation.

[Statutory Authority: 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-48029, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-48029. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48029, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48031 What operating procedures apply to cylinder manifolds?

- (1) Cylinder manifolds must be installed under the supervision of someone familiar with the proper practices of construction and use.
- (2) All component parts used in the methods of manifolding described in WAC 296-307-48023 must have the materials, design and construction approved either separately or as an assembled unit.
- (3) All manifolds and parts used in methods of manifolding must be used only for the gas or gases for which they are approved.

WAC 296-307-48031 (Cont.)

- (4) When acetylene cylinders are coupled, approved flash arresters must be installed between each cylinder and the coupler block. For outdoor use only, and when the number of cylinders coupled does not exceed three, one flash arrester installed between the coupler block and regulator is acceptable.
- (5) Each fuel-gas cylinder lead should have a backflow check valve.
- (6) The maximum aggregate capacity of fuel-gas cylinders connected to a portable manifold inside a building must be 3,000 cubic feet of gas.
- (7) Acetylene and liquefied fuel-gas cylinders must be manifolded vertically.
- (8) The pressure in the gas cylinders connected to and discharged simultaneously through a common manifold must be approximately equal.

[Statutory Authority: 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-48031, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-48031. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48031, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48033 How must service piping systems be designed?

- (1) Piping and fittings must comply with Section 2, Industrial Gas and Air Piping Systems, of the American National Standard Code for Pressure Piping, ANSI B 31.1-1967, if they do not conflict with subsections (2) and (3) of this section.
- (2) Pipe must be at least Schedule 40 and fittings must be at least standard weight in sizes up to and including 6-inch nominal.
- (3) Copper tubing must be Types K or L according to the Standard Specification for Seamless Copper Water Tube, ASTM B88-66a.
- (4) Piping must be steel, wrought iron, brass or copper pipe, or seamless copper, brass or stainless steel tubing, except as provided in subsections (5) through (9) of this section.
- (5) Oxygen piping and fittings at pressures in excess of 700 psig, must be stainless steel or copper alloys.
- (6) Hose connections and hose complying with WAC 296-307-48051 may be used to connect the outlet of a manifold pressure regulator to piping if the working pressure of the piping is 250 psig or less and the length of the hose is a maximum of 5 feet. Hose must have a minimum bursting pressure of 1,000 psig.
- (7) When oxygen is supplied to a service piping system from a low-pressure oxygen manifold without an intervening pressure regulating device, the piping system must have a minimum design pressure of 250 psig. A pressure regulating device must be used at each station outlet when the connected equipment is for use at pressures less than 250 psig.
- (8) Piping for acetylene or acetylenic compounds must be steel or wrought iron.
- (9) Unalloyed copper must only be used for acetylene or acetylenic compounds in listed equipment.

[Statutory Authority: 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-48033, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-48033. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48033, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48035 What requirements apply to piping joints?

- (1) Joints in steel or wrought iron piping must be welded, threaded or flanged. Fittings, such as ells, tees, couplings, and unions, must be rolled, forged or cast steel, malleable iron or nodular iron. Gray or white cast iron fittings are prohibited.

WAC 296-307-48035 (Cont.)

- (2) Joints in brass or copper pipe must be welded, brazed, threaded, or flanged. Socket type joints must be brazed with silver-brazing alloy or similar high melting point (not less than 800°F) filler metal.
- (3) Joints in seamless copper, brass, or stainless steel tubing must be approved gas tubing fittings or the joints must be brazed. Socket type joints must be brazed with silver-brazing alloy or similar high melting point (not less than 800°F) filler metal.

[Recodified as § 296-307-48035. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48035, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48037 How must service piping systems be installed?

- (1) Distribution lines must be installed and maintained in a safe operating condition.
- (2) Piping may be above or below ground. All piping must be run as directly as practical, protected against physical damage, with an allowance for expansion and contraction, jarring and vibration. Pipe laid underground in earth must be below the frost line and protected against corrosion. After assembly, piping must be thoroughly blown out with air or nitrogen to remove foreign materials. For oxygen piping, only oil-free air, oil-free nitrogen, or oil-free carbon dioxide must be used.
- (3) Only piping that has been welded or brazed must be installed in tunnels, trenches or ducts. Shut-off valves must be located outside such conduits. Oxygen piping may be placed in the same tunnel, trench or duct with fuel-gas pipelines, if there is good natural or forced ventilation.
- (4) Low points in piping carrying moist gas must be drained into drip pots constructed to permit pumping or draining out the condensate at necessary intervals. Drain valves must be installed for this purpose having outlets normally closed with screw caps or plugs. Open end valves or petcocks are prohibited, except that in drips located outdoors, underground, and not readily accessible, valves may be used at such points if they have means to secure them in the closed position. Pipes leading to the surface of the ground must be cased or jacketed where necessary to prevent loosening or breaking.
- (5) Gas cocks or valves must be provided for all buildings at points where they will be readily accessible for shutting off the gas supply to these buildings in any emergency. Underground valve boxes or manholes should be avoided wherever possible. There must be a shut-off valve in the discharge line from the generator, gas holder, manifold or other source of supply.
- (6) Shut-off valves must not be installed in safety-relief lines in such a manner that the safety-relief device can be rendered ineffective.
- (7) Fittings and lengths of pipe must be examined internally before assembly and, if necessary, freed from scale or dirt. Oxygen piping and fittings must be washed out with a suitable solution that will effectively remove grease and dirt but will not react with oxygen.

Note: Hot water solutions of caustic soda or trisodium phosphate are effective for this purpose.

- (8) Piping must be thoroughly blown out after assembly to remove foreign materials. For oxygen piping, oil-free air, oil-free nitrogen, or oil-free carbon dioxide must be used. For other piping, air or inert gas may be used.
- (9) When flammable gas lines or other parts of equipment are being purged of air or gas, open lights or other sources of ignition are prohibited near uncapped openings.

WAC 296-307-48037 (Cont.)

- (10) No welding or cutting must be performed on an acetylene or oxygen pipeline, including the attachment of hangers or supports, until the line has been purged. Only oil-free air, oil-free nitrogen, or oil-free carbon dioxide must be used to purge oxygen lines.

[Recodified as § 296-307-48037. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48037, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48039 How must service piping systems be painted and marked?

- (1) Underground pipe and tubing and outdoor ferrous pipe and tubing must be covered or painted with a suitable material for protection against corrosion.
- (2) Aboveground piping systems must be marked according to the American National Standard Scheme for the Identification of Piping Systems, ANSI A 13.1-1956.
- (3) Station outlets must be marked to indicate the name of the gas.

[Recodified as § 296-307-48039. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48039, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48041 How must service piping systems be tested?

- (1) Piping systems must be tested and proved gastight at 1-1/2 times the maximum operating pressure, and must be thoroughly purged of air before being placed in service. The material used for testing oxygen lines must be oil free and noncombustible. Flames must not be used to detect leaks.
- (2) When flammable gas lines or other parts of equipment are being purged of air or gas, sources of ignition are prohibited near uncapped openings.

[Recodified as § 296-307-48041. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48041, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48043 How must equipment be installed? Equipment shall be installed and used only in the service for which it is approved and as recommended by the manufacturer.

[Recodified as § 296-307-48043. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48043, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48045 How must service piping systems be protected? Service piping systems must be protected by pressure relief devices set to function at not more than the design pressure of the systems and discharging upwards to a safe location.

[Recodified as § 296-307-48045. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48045, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48047 What requirements apply to piping protective equipment?

- (1) The fuel-gas and oxygen piping systems, including portable outlet headers must incorporate the protective equipment shown in Figures V-1, V-2, and V-3.

When only a portion of a fuel-gas system is to be used with oxygen, only that portion must meet this requirement.

- (2) Approved protective equipment (designated PF in Figs. V-1, V-2, and V-3) must be installed in fuel-gas piping to prevent:
- (a) Backflow of oxygen into the fuel-gas supply system;
 - (b) Passage of a flash back into the fuel-gas supply system; and

WAC 296-307-48047 (Cont.)

- (c) Excessive back pressure of oxygen in the fuel-gas supply system. The three functions of the protective equipment may be combined in one device or may be provided by separate devices.

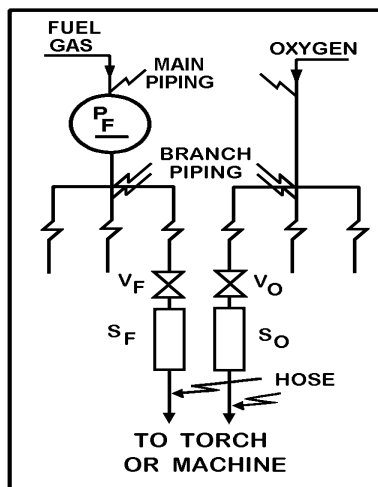


Fig. 1

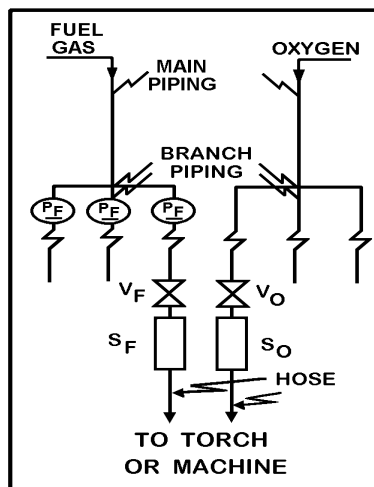


Fig. 2

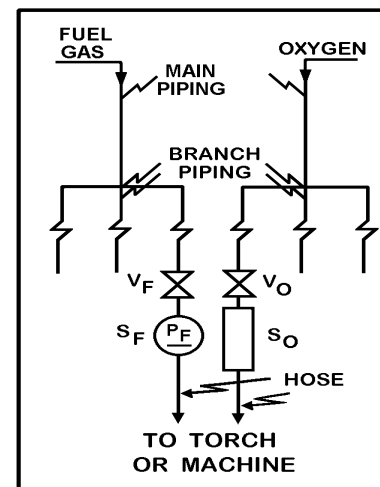


Fig. 3

PF = Protective equipment in fuel-gas piping
VF = Fuel-gas station outlet valve
VO = Oxygen station outlet valve
SF = Backflow prevention device(s) at fuel-gas station outlet
SO = Backflow prevention device(s) at oxygen station outlet

- (3) The protective equipment must be located in the main supply line, as in Figure 1 or at the head of each branch line, as in Figure 2 or at each location where fuel-gas is withdrawn, as in Figure 3. Where branch lines are of 2-inch pipe size or larger or of substantial length, protective equipment (designated as PF) shall be located as shown in either 2 or 3.
- (4) Backflow protection must be provided by an approved device that will prevent oxygen from flowing into the fuel-gas system or fuel from flowing into the oxygen system (see SF, Figs. 1 and 2).
- (5) Flash-back protection must be provided by an approved device that will prevent flame from passing into the fuel-gas system.
- (6) Back-pressure protection must be provided by an approved pressure-relief device set at a pressure not greater than the pressure rating of the backflow or the flashback protection device, whichever is lower. The pressure-relief device must be located on the downstream side of the backflow and flashback protection devices. The vent from the pressure-relief device must be at least as large as the relief device inlet and must be installed without low points that may collect moisture. If low points are unavoidable, drip pots with drains closed with screw plugs or caps shall be installed at the low points. The vent terminus must not endanger personnel or property through gas discharge; must be located away from ignition sources; and must terminate in a hood or bend.
- (7) If pipeline protective equipment incorporates a liquid, the liquid level must be maintained, and a suitable antifreeze may be used to prevent freezing.

WAC 296-307-48047 (Cont.)

- (8) Fuel-gas for use with equipment not requiring oxygen must be withdrawn upstream of the piping protective devices.

[Recodified as § 296-307-48047. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48047, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48049 What requirements apply to station outlet protective equipment?

- (1) A check valve pressure regulator, hydraulic seal, or combination of these devices must be provided at each station outlet, including those on portable headers, to prevent backflow, as shown in Figures 1, 2, and 3 and designated as SF and SO.
- (2) When approved pipeline protective equipment (designated PF) is located at the station outlet as in Figure 3, no additional check valve, pressure regulator, or hydraulic seal is required.
- (3) Each station outlet must have a shut-off valve (designated VF and VO) installed on the upstream side of other station outlet equipment.
- (4) If the station outlet is equipped with a detachable regulator, the outlet must terminate in a union connection that meets the requirements of the Regulator Connection Standards, 1958, Compressed Gas Association.
- (5) If the station outlet is connected directly to a hose, the outlet must terminate in a union connection that meets the requirements of the Standard Hose Connection Specifications, 1957, Compressed Gas Association.
- (6) Station outlets may terminate in pipe threads to which permanent connections are to be made, such as to a machine.
- (7) Station outlets must have a detachable outlet seal cap secured in place. This cap must be used to seal the outlet except when a hose, a regulator, or piping is attached.
- (8) Where station outlets are equipped with approved backflow and flashback protective devices, as many as four torches may be supplied from one station outlet through rigid piping, if each outlet from such piping, is equipped with a shut-off valve and if the fuel-gas capacity of any one torch does not exceed 15 cubic feet per hour. This rule does not apply to machines.

[Recodified as § 296-307-48049. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48049, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48051 What requirements apply to hose and hose connections?

- (1) Hose for oxy-fuel gas service must meet the requirements of the Specification for Rubber Welding Hose, 1958, Compressed Gas Association and Rubber Manufacturers Association.
- (2) The generally recognized colors are red for acetylene and other fuel-gas hose, green for oxygen hose, and black for inert-gas and air hose.
- (3) When parallel lengths of oxygen and acetylene hose are taped together for convenience and to prevent tangling, a maximum of 4 inches out of 12 inches must be covered by tape.
- (4) Hose connections must meet the requirements of the Standard Hose Connection Specifications, 1957, Compressed Gas Association.

WAC 296-307-48051 (Cont.)

- (5) Hose connections must be clamped or otherwise securely fastened so they will withstand, without leakage, twice the pressure to which they are normally subjected in service, but never less than a pressure of 300 psi. Oil-free air or an oil-free inert gas must be used for the test.
- (6) Hose showing leaks, burns, worn places, or other defects rendering it unfit for service must be repaired or replaced.

[Recodified as § 296-307-48051. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48051, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48053 What requirements apply to pressure-reducing regulators?

- (1) Pressure-reducing regulators must be used only for the gas and pressures for which they are intended. The regulator inlet connections must meet the requirements of the Regulator Connection Standards, 1958, Compressed Gas Association.
- (2) When regulators or parts of regulators, including gauges, need repair, the work must be performed by skilled mechanics who have been properly instructed.
- (3) Gauges on oxygen regulators must be marked "USE NO OIL."
- (4) Union nuts and connections on regulators must be inspected before use to detect faulty seats that may cause leakage of gas when the regulators are attached to the cylinder valves. Damaged nuts or connections must be destroyed.

[Recodified as § 296-307-48053. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48053, filed 10/31/96, effective 12/1/96.]

WAC 296-307-485 Installation and operation of resistance welding equipment.

[Recodified as § 296-307-485. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-485, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48501 What general requirements apply to resistance welding equipment?

- (1) All equipment must be installed by a qualified electrician according to the requirements of chapter 296-307 WAC Part T. There must be a safety-type disconnecting switch or a circuit breaker or circuit interrupter to open each power circuit to the machine, conveniently located at or near the machine, so that the power can be shut off when the machine or its controls are to be serviced.
- (2) Ignitron tubes used in resistance welding equipment must have a thermal protection switch.
- (3) Employees designated to operate resistance welding equipment must have been properly instructed and judged competent to operate such equipment.
- (4) Controls of all automatic or air and hydraulic clamps must be arranged or guarded to prevent the operator from accidentally activating them.

[Statutory Authority: 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-48501, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-48501. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48501, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48503 What requirements apply to portable welding machines?

- (1) All portable welding guns must have suitable counter-balanced devices for supporting the guns, including cables, unless the design of the gun or fixture makes counterbalancing impractical or unnecessary.
- (2) All portable welding guns, transformers, and related equipment that is suspended from overhead structures, eye beams, or trolleys must have safety chains or cables. Safety chains or cables shall be able to support the total shock load in the event of failure of any component of the supporting system.

WAC 296-307-48503 (Cont.)

- (3) When trolleys are used to support portable welding equipment, they must have suitable forged steel clevis for the attachment of safety chains. Each clevis must be able to support the total shock load of the suspended equipment in the event of trolley failure.
- (4) All initiating switches, including retraction and dual schedule switches, located on the portable welding gun must have suitable guards able to prevent accidental initiation through contact with fixturing, operator's clothing, etc. Initiating switch voltage must be a maximum of 24 volts.
- (5) The movable holder, where it enters the gun frame, must have enough clearance to prevent the shearing an operator's fingers if placed on the operating movable holder.
- (6) The secondary and case of all portable welding transformers must be grounded. Secondary grounding may be by center tapped secondary or by a center tapped grounding reactor connected across the secondary.
[Recodified as § 296-307-48503. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48503, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48505 What requirements apply to flash welding equipment?

- (1) Flash welding machines must have a hood to control flying flash. In cases of high production, where materials may contain a film of oil and where toxic elements and metal fumes are given off, ventilation must be provided according to WAC 296-307-50009 through 296-307-50029.
- (2) For the protection of the operators of nearby equipment, fire-resistant curtains or suitable shields must be set up around the machine and in such a manner that the operator's movements are not hampered.
- (3) If the welding process cannot be isolated, anyone who may be exposed to the hazard of arc flash must be properly protected.
[Statutory Authority: 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-48505, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-48505. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48505, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48507 Who must perform a job hazard analysis? A qualified person must perform a job hazard analysis on the operations to be performed on each welding machine to determine the safeguards and personal protective equipment that shall be used for each job.
[Recodified as § 296-307-48507. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48507, filed 10/31/96, effective 12/1/96.]

WAC 296-307-48509 What maintenance requirements apply to resistance welding equipment? Qualified maintenance personnel must periodically inspect the equipment and maintain records of the inspections. The operator must be instructed to report any equipment defects to the supervisor and the use of the equipment must be discontinued until safety repairs have been completed.
[Recodified as § 296-307-48509. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-48509, filed 10/31/96, effective 12/1/96.]

WAC 296-307-490 Application, installation, and operation of arc welding and cutting equipment.
[Recodified as § 296-307-490. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-490, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49001 What environmental conditions must be taken into account when selecting arc welding equipment?

Note: You may ensure that your equipment is designed for safety by choosing equipment that complies with the Requirements for Electric Arc-Welding Apparatus, NEMA EW-1-1962, National Electrical Manufacturers Association or the Safety Standard for Transformer-Type Arc-Welding Machines, ANSI C33.2-1956, Underwriters' Laboratories.

WAC 296-307-49001 (Cont.)

- (1) Standard machines for arc welding service must be designed and constructed to carry their rated load with rated temperature rises where the temperature of the cooling air is a maximum of 40°C (104°F) and where the altitude is a maximum of 3,300 feet, and must be suitable for operation in atmospheres containing gases, dust, and light rays produced by the welding arc.
- (2) When exposed to the following or other conditions, machines must be designed to safely meet the requirements of the service.
 - Unusually corrosive fumes;
 - Steam or excessive humidity;
 - Excessive oil vapor;
 - Flammable gases;
 - Abnormal vibration or shock;
 - Excessive dust;
 - Weather;
 - Unusual seacoast or shipboard conditions.

[Recodified as § 296-307-49001. 97-09-013, filed 4/7/97; effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17] 050 and [49.17] 060. 96-22-048, § 296-306A-49001, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49003 What voltages must arc welding equipment use? Open circuit (no load) voltages of arc welding and cutting machines should be as low as possible consistent with satisfactory welding or cutting being done. Following are the maximum limits:

- (1) For alternating-current machines:
 - (a) Manual arc welding and cutting-80 volts.
 - (b) Automatic (machine or mechanized) arc welding and cutting-100 volts.
- (2) For direct-current machines:
 - (a) Manual arc welding and cutting-100 volts.
 - (b) Automatic (machine or mechanized) arc welding and cutting-100 volts.
- (3) When special welding and cutting processes require values of open circuit voltages higher than the above, means must be provided to prevent the operator from making accidental contact with the high voltage by adequate insulation or other means.

Note: For a.c. welding under wet conditions or warm surroundings where perspiration is a factor, the use of reliable automatic controls for reducing no load voltage is recommended to reduce the shock hazard.

[Recodified as § 296-307-49003. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49003, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49005 How must arc welding equipment be designed?

- (1) A controller integrally mounted in an electric motor driven welder must be able to carry the rated motor current, must be able to make and interrupt stalled rotor current of the motor, and may serve as the running overcurrent device if provided with the number of over-current units as specified by chapter 296-307 WAC Part T. Starters with magnetic undervoltage release should be used with machines installed more than one to a circuit to prevent circuit overload caused by simultaneously starting several motors upon return of voltage.
- (2) On all types of arc welding machines, control apparatus must be enclosed except for the operating wheels, levers, or handles.

Note: Control handles and wheels should be large enough to be easily grasped by a gloved hand.

- (3) Input power terminals, tap change devices, and live metal parts connected to input circuits must be completely enclosed and accessible only by tools.
- (4) Terminals for welding leads should be protected from accidental electrical contact by employees or by metal objects i.e., vehicles, crane hooks, etc. You may provide protection with:
 - Dead-front receptacles for plug connections;
 - Recessed openings with nonremovable hinged covers;
 - Heavy insulating sleeving or taping; or
 - Other equivalent electrical and mechanical protection.

If a welding lead terminal that is intended to be used exclusively for connection to the work is connected to the grounded enclosure, it must be done by a conductor at least two AWG sizes smaller than the grounding conductor and the terminal must be marked to indicate that it is grounded.

- (5) No connections for portable control devices (such as push buttons to be carried by the operator) must be connected to an a.c. circuit of higher than 120 volts. Exposed metal parts of portable control devices operating on circuits above 50 volts must be grounded by a grounding conductor in the control cable.
- (6) Auto transformers or a.c. reactors must not be used to draw welding current directly from any a.c. power source having a voltage exceeding 80 volts.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-49005, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-49005. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49005, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49007 How must arc welding equipment be installed? Arc welding equipment, including the power supply, must be installed according to the requirements of chapter 296-307 WAC Part T.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-49007, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-49007. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49007, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49009 How must arc welding equipment be grounded?

- (1) The frame or case of the welding machine (except engine-driven machines) must be grounded according to the requirements of chapter 296-307 WAC Part T.
- (2) Conduits containing electrical conductors must not be used for completing a work-lead circuit. Pipelines must not be used as a permanent part of a work-lead circuit, but may be used during construction, extension or repair if current is not carried through threaded joints, flanged bolted joints, or caulked joints and special precautions are used to avoid sparking at connection of the work-lead cable.

WAC 296-307-49009 (Cont.)

- (3) Using chains, wire ropes, cranes, hoists, and elevators to carry welding current is prohibited.
- (4) Where a structure, conveyor, or fixture is regularly used as a welding current return circuit, joints must be bonded or provided with adequate current collecting devices and appropriate periodic inspection should be conducted to ensure that no electrocution, shock, or fire hazard exists.
- (5) All ground connections must be checked to determine that they are mechanically strong and electrically adequate for the required current.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-49009, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-49009. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49009, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49011 What requirements apply to supply connections and conductors?

- (1) A disconnecting switch or controller must be provided at or near each welding machine without a switch or controller mounted as an integral part of the machine. The switch must meet the requirements of chapter 296-307 WAC Part T. Overcurrent protection must be provided as specified in chapter 296-307 WAC Part T. A disconnect switch with overload protection or equivalent disconnect and protection means, permitted by chapter 296-307 WAC Part T must be provided for each outlet intended for connection to a portable welding machine.
- (2) For individual welding machines, the rated current-carrying capacity of the supply conductors must be at least that of the rated primary current of the welding machines.
- (3) For groups of welding machines, the rated current-carrying capacity of conductors may be less than the sum of the rated primary currents of the welding machines supplied. The conductor rating must be determined according to the machine loading based on the use to be made of each welding machine and the allowance permissible in the event that all the welding machines supplied by the conductors will not be in use at the same time.
- (4) In operations involving several welders on one structure, d.c. welding process requirements may require the use of both polarities; or supply circuit limitations for a.c. welding may require distribution of machines among the phases of the supply circuit. In such cases, no load voltages between electrode holders will be two times normal in d.c. or 1, 1.4, 1.73, or 2 times normal on a.c. machines. Similar voltage differences will exist if both a.c. and d.c. welding are done on the same structure.
 - (a) All d.c. machines must be connected with the same polarity.
 - (b) All a.c. machines must be connected to the same phase of the supply circuit and with the same instantaneous polarity.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-49011, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-49011. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49011, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49013 How must arc welding equipment be operated?

- (1) Employees assigned to operate or maintain arc welding equipment must be acquainted with the requirements of WAC 296-307-490, 296-307-495, and 296-307-500; if doing gas-shielded arc welding, also Recommended Safe Practices for Gas-Shielded Arc Welding, A6.1-1966, American Welding Society.
- (2) Before starting operations, all connections to the machine must be checked to make certain they are properly made. The work lead must be firmly attached to the work; magnetic work clamps shall be freed from adherent metal particles of spatter on contact surfaces. Coiled welding cable must be spread out before use to avoid serious overheating and damage to insulation.

WAC 296-307-49013 (Cont.)

- (3) You must ensure that the welding machine frame grounding is checked with special attention given to safety ground connections of portable machines.
- (4) Cylinders must be kept away from radiators, piping systems, layout tables, etc., that may be used for grounding electric circuits. Any practice such as the tapping of an electrode against a cylinder to strike an arc is prohibited.
- (5) There must be no leaks of cooling water, shielding gas or engine fuel.
- (6) You must ensure that the machine has proper switching equipment for shutting down.
- (7) Printed rules and instructions covering operation of equipment supplied by the manufacturers must be strictly followed.
- (8) Electrode holders when not in use must be placed so that they cannot make electrical contact with persons, conducting objects, fuel or compressed gas tanks.
- (9) Cables with splices within 10 feet of the holder are prohibited. The welder should not coil or loop welding electrode cable around parts of the body.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-49013, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-49013. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49013, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49015 How must arc welding equipment be maintained?

- (1) The operator should report any equipment defect or safety hazard to the supervisor and discontinue using the equipment until its safety is ensured. Repairs must be made only by qualified persons.
- (2) Machines that have become wet must be thoroughly dried and tested before being used.
- (3) Work and electrode lead cables should be frequently inspected for wear and damage. Cables with damaged insulation or exposed bare conductors must be replaced. Lengths of work and electrode cables must be joined by connecting means specifically intended for the purpose. The connecting means must have insulation adequate for the service conditions.

[Recodified as § 296-307-49015. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49015, filed 10/31/96, effective 12/1/96.]

WAC 296-307-495 Fire prevention and protection.

[Recodified as § 296-307-495. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-495, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49501 What basic fire prevention precautions must be taken? For more information on these basic precautions and the special precautions of WAC 296-307-49503, including fire protection and prevention responsibilities of welders, cutters, their supervisors (including outside contractors), and management, see the Standard for Fire Prevention in Use of Cutting and Welding Processes, NFPA Standard 51B, 1962.

The basic precautions for fire prevention in welding or cutting work are:

- (1) If the object to be welded or cut cannot readily be moved, all movable fire hazards in the vicinity must be taken to a safe place.
- (2) If the object to be welded or cut cannot be moved and if all the fire hazards cannot be removed, then guards must be used to confine the heat, sparks, and slag, and to protect the fire hazards.

WAC 296-307-49501 (Cont.)

(3) If the requirements of this section cannot be met, then welding and cutting are prohibited.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-49501, filed 12/01/98, effective 03/01/99 Recodified as § 296-307-49501. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49501, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49503 What special fire prevention precautions must be taken? When the nature of the work to be performed falls within the scope of WAC 296-307-49501(2), certain additional precautions may be necessary:

- (1) Wherever there are floor openings or cracks in the flooring that cannot be closed, precautions must be taken so that no readily combustible materials on the floor below will be exposed to sparks that drop through. The same precautions must be observed with regard to cracks or holes in walls, open doorways, and open or broken windows.
- (2) Suitable fire extinguishing equipment must be maintained in a state of readiness for instant use. Such equipment may consist of pails of water, buckets of sand, hose, or portable extinguishers depending upon the nature and quantity of the combustible material exposed.
- (3) The following requirements apply to fire watch:
 - (a) Fire watchers are required whenever welding or cutting is performed in locations where other than a minor fire might develop, or any of the following conditions exist:
 - (i) Appreciable combustible material, in building construction or contents, closer than 35 feet to the point of operation.
 - (ii) Appreciable combustibles are more than 35 feet away but are easily ignited by sparks.
 - (iii) Wall or floor openings within a 35-foot radius expose combustible material in adjacent areas including concealed spaces in walls or floors.
 - (iv) Combustible materials are adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and are likely to be ignited by conduction or radiation.
 - (b) Fire watchers must have fire extinguishing equipment readily available and be trained in its use. They must be familiar with facilities for sounding an alarm in the event of a fire. They must watch for fires in all exposed areas, try to extinguish them only when obviously within the capacity of the equipment available, or otherwise sound the alarm. A fire watch must be maintained for at least a half hour after completion of welding or cutting operations to detect and extinguish possible smoldering fires.
- (4) Before cutting or welding is permitted, the area must be inspected by the individual responsible for authorizing cutting and welding operations. The responsible individual must designate precautions to be followed in granting authorization to proceed, preferably in the form of a written permit.
- (5) Where combustible materials such as paper clippings, wood shavings, or textile fibers are on the floor, the floor must be swept clean for a radius of 35 feet. Combustible floors must be kept wet, covered with damp sand, or protected by fire-resistant shields. Where floors have been wet down, employees operating arc welding or cutting equipment must be protected from possible shock.
- (6) Cutting and welding are prohibited in the following situations:
 - (a) In areas not authorized by management.

WAC 296-307-49503 (Cont.)

- (b) In sprinklered buildings while such protection is impaired.
 - (c) In the presence of explosive atmospheres (mixtures of flammable gases, vapors, liquids, or dusts with air), or where explosive atmospheres may develop inside uncleaned or improperly prepared tanks or equipment that have previously contained such materials, or that may develop in areas with an accumulation of combustible dusts.
 - (d) In areas near the storage of large quantities of exposed, readily ignitable materials such as bulk sulphur, baled paper, or cotton.
- (7) Where practical, all combustibles must be relocated at least 35 feet from the worksite. Where relocation is impractical, combustibles must be protected with flameproofed covers or otherwise shielded with metal or asbestos guards or curtains. Edges of covers at the floor should be tight to prevent sparks from going under them. This precaution is also important at overlaps where several covers are used to protect a large pile.
- (8) Ducts and conveyor systems that might carry sparks to distant combustibles must be suitably protected or shut down.
- (9) Where cutting or welding is done near walls, partitions, ceiling, or roof of combustible construction, fire-resistant shields or guards must be provided to prevent ignition.
- (10) If welding is to be done on a metal wall, partition, ceiling, or roof, precautions must be taken to prevent ignition of combustibles on the other side, due to conduction or radiation, preferably by relocating combustibles. Where combustibles are not relocated, a fire watch on the opposite side from the work must be provided.
- (11) Welding must not be attempted on a metal partition, wall, ceiling, or roof having a combustible covering nor on walls or partitions of combustible sandwich-type panel construction.
- (12) Cutting or welding on pipes or other metal in contact with combustible walls, partitions, ceilings or roofs must not be undertaken if the work is close enough to cause ignition by conduction.
- (13) You are responsible for the safe use of cutting and welding equipment on your property and:
- (a) Based on fire potentials of plant facilities, you must establish areas and procedures for cutting and welding;
 - (b) You must designate an individual responsible for authorizing cutting and welding operations in areas not specifically designed for such processes;
 - (c) You must insist that cutters or welders and their supervisors are suitably trained in the safe operation of their equipment and the safe use of the process; and
 - (d) You must advise all contractors about flammable materials or hazardous conditions of which they may not be aware.
- (14) The supervisor must:
- (a) Ensure that cutting and welding equipment is handled and used safely.
 - (b) Determine the combustible materials and hazardous areas present or likely to be present in the work location.

WAC 296-307-49503 (Cont.)

- (c) Protect combustibles from ignition by the following:
 - (i) Have the work moved to a location free from dangerous combustibles;
 - (ii) If the work cannot be moved, have the combustibles moved to a safe distance from the work or have the combustibles properly shielded against ignition; and
 - (iii) See that cutting and welding are so scheduled that plant operations that might expose combustibles to ignition are not started during cutting or welding.
 - (d) Secure authorization for the cutting or welding operations from the designated management representative.
 - (e) Determine that the cutter or welder secures their approval that conditions are safe before going ahead;
 - (f) Determine that fire protection and extinguishing equipment are properly located at the site; and
 - (g) Ensure fire watches are available at the site when required.
- (15) Cutting or welding is permitted only in areas that are or have been made fire safe. Within the confines of an operating plant or building, cutting and welding should preferably be done in a specific area designed for such work, such as a maintenance shop or a detached outside location. Such areas should be of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas. When work cannot be moved practically, as in most construction work, the area must be made safe by removing combustibles or protecting combustibles from ignition sources.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-49503, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-49503. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49503, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49505 What precautions must be taken when welding or cutting containers?

- (1) No welding, cutting, or other hot work may be performed on used drums, barrels, tanks or other containers until they have been cleaned thoroughly enough to be certain that there are no flammable materials present or any substances such as greases, tars, acids, or other materials which when subjected to heat, might produce flammable or toxic vapors. Any pipe lines or connections to the drum or vessel must be disconnected or blanked.
- (2) All hollow spaces, cavities, or containers must be vented to permit the escape of air or gases before preheating, cutting or welding. Purging with inert gas is recommended.

[Recodified as § 296-307-49505. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49505, filed 10/31/96, effective 12/1/96.]

WAC 296-307-49507 What precautions must be taken when welding in confined spaces?

- (1) When arc welding work is stopped for a substantial time, such as during lunch or overnight, all electrodes must be removed from the holders and the holders carefully located so that accidental contact cannot occur and the machine be disconnected from the power source.
- (2) In order to eliminate the possibility of gas escaping through leaks or improperly closed valves, when gas welding or cutting, the torch valves must be closed and the gas supply to the torch positively shut off at some point outside the confined area whenever the torch is not to be used for a substantial period of time,

WAC 296-307-49507 (Cont.)

such as during lunch hour or overnight. Where practical, the torch and hose must also be removed from the confined space.

[Recodified as § 296-307-49507. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-49507, filed 10/31/96, effective 12/1/96.]

WAC 296-307-500 Protection of employees.

[Recodified as § 296-307-500. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-500, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50001 How must eye protection be selected?

- (1) Helmets or hand shields must be used during all arc welding or arc cutting operations, excluding submerged arc welding. Goggles should also be worn during arc welding or cutting operations to provide protection from injurious rays from adjacent work, and from flying objects. The goggles may have either clear or colored glass, depending on the amount of exposure to adjacent welding operations. Helpers or attendants must have proper eye protection.
- (2) Goggles or other suitable eye protection must be used during all gas welding or oxygen cutting operations. Spectacles without side shields, with suitable filter lenses are permitted for use during gas welding operations on light work, for torch brazing, or for inspection.
- (3) All operators and attendants of resistance welding or resistance brazing equipment must use transparent face shields or goggles, depending on the job, to protect their faces or eyes as required.
- (4) Suitable goggles must be provided where needed for brazing operations not above.

[Recodified as § 296-307-50001. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50001, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50003 What specifications must eye protection meet?

- (1) Helmets and hand shields must be made of a material that is an insulator for heat and electricity. Helmets, shields and goggles must be not readily flammable and must be able to be sterilized.
- (2) Helmets and hand shields must be arranged to protect the face, neck and ears from direct radiant energy from the arc.
- (3) Helmets must have filter plates and cover plates designed for easy removal.
- (4) All parts must be constructed of a material that will not readily corrode or discolor the skin.
- (5) Goggles must be ventilated to prevent fogging of the lenses as much as practical.
- (6) Cover lenses or plates should be provided to protect each helmet, hand shield, or goggle filter lens or plate.
- (7) All glass for lenses must be tempered, substantially free from scratches, air bubbles, waves and other flaws. Except when a lens is ground to provide proper optical correction for defective vision, the front and rear surfaces of lenses and windows must be smooth and parallel.
- (8) Lenses must be marked with the source and shade.
- (9) Following is a guide to select proper shade numbers. Individual needs may vary.

WAC 296-307-50003 (Cont.)

Welding Operation	Shade No.
Shielded metal-arc welding--1/16-, 3/32-, 1/8-, 5/32-inch electrodes	10
Gas-shielded arc welding (nonferrous)-1/16-, 3/32-, 1/8-, 5/32-inch electrodes	11
Gas-shielded arc welding (ferrous)-1/16-, 3/32-, 1/8-, 5/32-inch electrodes	12
Shielded metal-arc welding: 3/16-, 7/32-, 1/4-inch electrodes	12
5/16-, 3/8-inch electrodes	14
Atomic hydrogen welding	10-14
Carbon arc welding	14
Soldering	2
Torch brazing	3 or 4
Light cutting, up to 1 inch	3 or 4
Medium cutting, 1 inch to 6 inches	4 or 5
Heavy cutting, 6 inches and over	5 or 6
Gas welding (light) up to 1/8 inch	4 or 5
Gas welding (medium) 1/8 inch to 1/2 inch	5 or 6
Gas welding (heavy) 1/2 inch and over	6 or 8
<i>Note: In gas welding or oxygen cutting where the torch produces a high yellow light it is desirable to use a filter or lens that absorbs the yellow or sodium line in the visible light of the operation.</i>	

- (10) All filter lenses and plates must meet the test for transmission of radiant energy prescribed in ANSI Z 87.1-1968--American National Standard Practice for Occupational and Educational Eye and Face Protection.
- (11) Where the work permits, an arc welder should be enclosed in an individual booth painted with a finish of low-reflectivity such as zinc oxide (an important factor for absorbing ultraviolet radiations) and lamp black, or must be enclosed with noncombustible screens similarly painted. Booths and screens must permit circulation of air at floor level. Employees or other persons adjacent to the welding areas must be protected from the rays by noncombustible or flameproof screens or shields or must be required to wear appropriate goggles.

[Recodified as § 296-307-50003. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50003, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50005 What protective clothing must welders wear?

- (1) Employees exposed to the hazards created by welding, cutting, or brazing operations must be protected by personal protective equipment according to the requirements of chapter 296-307 WAC Part H. Appropriate protective clothing required for any welding operation will vary with the size, nature and location of the work to be performed.
- (2) The following suggestions may be helpful when choosing protective clothing:
- (a) Except when engaged in light work, all welders should wear flameproof gauntlet gloves.
 - (b) Flameproof aprons made of leather, asbestos, or other suitable material may help to protect against radiated heat and sparks.

WAC 296-307-50005 (Cont.)

- (c) Woolen clothing is better than cotton because it is less easily ignited and helps to protect the welder from changes in temperature. Cotton clothing, if used, should be chemically treated to reduce its combustibility. All outer clothing such as jumpers or overalls should be reasonably free from oil or grease.
- (d) Sparks may lodge in rolled-up sleeves, pockets, or cuffs. Therefore sleeves and collars should be buttoned, and clothing should have no front pockets. Trousers or overalls should be uncuffed.
- (e) For heavy work, fire-resistant leggings, high boots, or other equivalent means should be used.
- (f) In production work a sheet metal screen in front of the employee's legs can provide further protection against sparks and molten metal in cutting operations.
- (g) Capes or shoulder covers made of leather or other suitable materials should be worn during overhead welding or cutting operations. Leather skull caps may be worn under helmets to prevent head burns.
- (h) For welding and cutting overhead or in extremely confined spaces, ear protection is sometimes desirable.
- (i) Where there is exposure to sharp or heavy falling objects, or a hazard of bumping in confined spaces, hard hats or head protectors must be used.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-50005, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-50005. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50005, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50007 What other requirements apply to employee protection?

- (1) You must ensure that a welder or helper working on platforms, scaffolds, or runways is protected against falling by using railings, safety belts, life lines, or other equally effective safeguards.
- (2) Welders must place welding cable and other equipment so that it is clear of passageways, ladders, and stairways.

[Recodified as § 296-307-50007. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50007, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50009 What employee protection must be provided in confined spaces?

“Confined space” means a relatively small or restricted space such as a tank, boiler, pressure vessel, or small compartment of a ship.

- (1) Confined spaces must be ventilated. For ventilation requirements see WAC 296-307-50011 through 296-307-50029.
- (2) When welding or cutting in a confined space, the gas cylinders and welding machines must be left outside. Before operations are started, heavy portable equipment mounted on wheels must be securely blocked to prevent accidental movement.
- (3) Where a welder must enter a confined space through a manhole or other small opening, means must be provided for quickly removing the welder in case of emergency. When safety belts and lifelines are used, they must be attached so that the welder's body cannot be jammed in a small exit opening. An attendant with a preplanned rescue procedure must be stationed outside to observe the welder at all times and be able to put rescue operations into effect.

WAC 296-307-50009 (Cont.)

- (4) After welding operations are completed, the welder must mark the hot metal or provide some other means of warning other employees.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-50009, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-50009. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50009, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50011 What general requirements apply to welding ventilation?

- (1) The following three factors in arc and gas welding must be considered when determining the amount of contamination to which welders may be exposed:
- (a) Dimensions of space in which welding is to be done (especially ceiling height);
 - (b) Number of welders; and
 - (c) The possibility of hazardous fumes, gases, or dust according to the metals involved.
- (2) Other factors involved may require ventilation or respiratory protective devices as needed to meet the requirements of this section. Such factors include:
- (a) Atmospheric conditions;
 - (b) Heat generated; and
 - (c) Presence of volatile solvents.
- (3) When welding must be performed in a space entirely screened on all sides, the screens must be arranged so that no serious restriction of ventilation exists. The screens should be mounted so that they are about 2 feet above the floor unless the work is performed at so low a level that the screen must be extended nearer to the floor to protect nearby employees from the glare of welding.
- (4) Local exhaust or general ventilating systems must be provided and arranged to keep the amount of toxic fumes, gases, or dusts below the maximum allowable in chapter 296-62 WAC.
- Note:* A number of potentially hazardous materials are employed in fluxes, coatings, coverings, and filler metals used in welding and cutting or are released to the atmosphere during welding and cutting. These include but are not limited to the materials itemized in WAC 296-307-50019 through 296-307-50029.
- (5) You must determine which potentially hazardous materials are associated with welding and cutting and inform employees through signs, labels or other appropriate means.
- (a) Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. Use adequate ventilation. See ANSI Z 49.1-1967, Safety in Welding and Cutting, published by the American Welding Society.
 - (b) Brazing (welding) filler metals containing cadmium in significant amounts must carry the following notice on tags, boxes, or other containers:

WAC 296-307-50011 (Cont.)

WARNING

CONTAINS CADMIUM-POISONOUS FUMES MAY BE FORMED ON HEATING

- Do not breathe fumes. Use only adequate ventilation such as fume collectors, exhaust ventilators, or air-supplied respirators. See ANSI Z 49.1-1967.
- If chest pain, cough, or fever develops after use call physician immediately.
- Keep children away when using.

- (c) Brazing and gas welding fluxes containing fluorine compounds must have a cautionary wording to indicate that they contain fluorine compounds. The American Welding Society recommends the following for brazing and gas welding fluxes:

CAUTION

CONTAINS FLUORIDES

This flux when heated gives off fumes that may irritate eyes, nose and throat.

- Avoid fumes. Use only in well-ventilated spaces.
- Avoid contact of flux with eyes or skin.
- Do not take internally.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-50011, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-50011. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50011, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50013 What ventilation must be provided for general welding and cutting?

- (1) Mechanical ventilation must be provided when welding or cutting is done on metals not covered in WAC 296-307-50019 through 296-307-50029 in the following locations:
- (a) In a space of less than 10,000 cubic feet per welder.
 - (b) In a room with a ceiling height of less than 16 feet.
 - (c) In confined spaces or where the welding space contains partitions, balconies, or other structural barriers to the extent that they significantly obstruct cross-ventilation.
- (2) Ventilation must be at the minimum rate of 2,000 cubic feet per minute per welder.

Exception: This requirement does not apply where local exhaust hoods and booths that meet the requirements of WAC 296-307-50015, or airline respirators approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) for such purposes are provided. Natural ventilation is considered sufficient for welding or cutting operations where the restrictions in subsection (1) of this section are not present.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-50013, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-50013. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50013, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50015 What requirements apply to local exhaust hoods and booths? Mechanical local exhaust ventilation may be provided by either of the following:

- (1) Freely movable hoods intended to be placed by the welder as near as practical to the work being welded and provided with a rate of airflow sufficient to maintain a velocity in the direction of the hood of 100 linear feet per minute in the zone of welding when the hood is at its most remote distance from the point of welding. The rates of ventilation required to accomplish this control velocity using a 3-inch wide flanged suction opening are shown in the following table:

WAC 296-307-50015 (Cont.)

Welding Zone	Minimum air flow cubic feet/minute ¹	Duct Diameter Inches ²
4 to 6 inches from arc or torch	150	3
6 to 8 inches from arc or torch	275	3 1/2
8 to 10 inches from arc or torch	425	4 1/2
10 to 12 inches from arc or torch	600	5 1/2
¹ When brazing with cadmium brazing materials or when cutting on such materials increased rates of ventilation may be required.		
² Nearest half-inch duct diameter based on 4,000 feet per minute velocity in pipe.		

- (2) A fixed enclosure with a top and at least two sides that surround the welding or cutting operations and with a rate of airflow sufficient to maintain a velocity away from the welder of not less than 100 linear feet per minute.

[Recodified as § 296-307-50015. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50015, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50017 What ventilation must be provided in confined spaces?

- (1) All welding and cutting operations carried on in confined spaces must be adequately ventilated to prevent the accumulation of toxic materials or possible oxygen deficiency. This applies to welders, helpers, and other employees in the immediate vicinity. All replacement air must be clean and respirable.
- (2) In circumstances where it is impossible to provide such ventilation, airline respirators or hose masks approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) for this purpose must be used.
- (3) In areas immediately hazardous to life, hose masks with blowers or self-contained breathing equipment must be used. The breathing equipment must be approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH).
- (4) Where welding operations are carried on in confined spaces and where welders and helpers are provided with hose masks, hose masks with blowers or self-contained breathing equipment approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH), an employee must be stationed on the outside of such confined spaces to ensure the safety of those working within.

- (5) Oxygen must not be used for ventilation.

[Recodified as § 296-307-50017. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50017, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50019 What requirements apply to welding fluorine compounds? In confined spaces, welding or cutting involving fluxes, coverings, or other materials that contain fluorine compounds must be done according to WAC 296-307-50017.

“Fluorine compound” means a compound that contains fluorine as an element in chemical combination, not as a free gas.

Note: The need for local exhaust ventilation or airline respirators for welding or cutting in other than confined spaces will depend on the circumstances. However, such protection is desirable for fixed-location production welding and for all production welding on stainless steels. Where air samples taken at the

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welding location indicate that the fluorides liberated are below the maximum allowable concentration, such protection is not necessary.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-50019, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-50019. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50019, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50021 What requirements apply to welding zinc?

- (1) In confined spaces welding or cutting involving zinc-bearing base or filler metals or metals coated with zinc-bearing materials must be done according to WAC 296-307-50017.
- (2) Indoors, welding or cutting involving zinc-bearing base or filler metals coated with zinc-bearing materials must be done according to WAC 296-307-50015.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-50021, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-50021. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50021, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50023 What requirements apply to welding lead?

- (1) In confined spaces, welding involving lead-base metals (erroneously called lead-burning) must be done according to WAC 296-307-50017.
- (2) Indoors, welding involving lead-base metals must be done according to WAC 296-307-50015.
- (3) In confined spaces or indoors, welding or cutting involving metals containing lead, other than as an impurity, or involving metals coated with lead-bearing materials, including paint, must be done using local exhaust ventilation or airline respirators. Outdoors, such operations must be done using respiratory protective equipment approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) for such purposes. In all cases, employees in the immediate vicinity of the cutting operation must be protected as necessary by local exhaust ventilation or airline respirators.

Note: See chapter 296-62 WAC for additional requirements on lead.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-50023, filed 12/01/98, effective 03/01/99. Recodified as § 296-307-50023. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50023, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50025 What requirements apply to welding beryllium? Welding or cutting indoors, outdoors, or in confined spaces involving beryllium-containing base or filler metals must be done using local exhaust ventilation and airline respirators unless atmospheric tests under the most adverse conditions have established that employee exposure is within the acceptable concentrations defined by WAC 296-307-62625. In all cases, employees in the immediate vicinity of the welding or cutting operations must be protected as necessary by local exhaust ventilation or airline respirators.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 05-01-166 (Order 04-19), § 296-307-50025, filed 12/21/04, effective 04/02/05. Recodified as § 296-307-50025. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50025, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50027 What requirements apply to welding cadmium?

- (1) Welding or cutting indoors or in confined spaces involving cadmium-bearing or cadmium-coated base metals must be done using local exhaust ventilation or airline respirators unless atmospheric tests under the most adverse conditions have established that employee exposure is within the acceptable concentrations defined by chapter 296-62 WAC. Outdoors, such operations must be done using respiratory protective

WAC 296-307-50027 (Cont.)

equipment such as fume respirators approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) for such purposes.

- (2) Welding (brazing) involving cadmium-bearing filler metals must be done using ventilation as prescribed in WAC 296-307-50015 or 296-307-50017 if the work is to be done in a confined space.

Note: See chapter 296-62 WAC for additional requirements on cadmium.

[Statutory Authority: Chapter 49.17.040 RCW. 98-24-096 (Order 98-13) § 296-307-50027, filed 12/01/98, effective 03/01/99.

Recodified as § 296-307-50027. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50027, filed 10/31/96, effective 12/1/96.]

WAC 296-307-50029 What requirements apply to welding mercury? Welding or cutting indoors or in a confined space involving metals coated with mercury-bearing materials, including paint, must be done using local exhaust ventilation or airline respirators unless atmospheric tests under the most adverse conditions have established that employee exposure is within the acceptable concentrations defined by WAC 296-307-62625. Outdoors, such operations must be done using respiratory protective equipment approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) for such purposes.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 05-01-166 (Order 04-19), § 296-307-50029, filed 12/21/04, effective 04/02/05. Recodified as § 296-307-50029. 97-09-013, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.] 050 and [49.17.] 060. 96-22-048, § 296-306A-50029, filed 10/31/96, effective 12/1/96.]